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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/305,121 | 05/04/1999 | SARATH D. GUNAPALA | 06816/065002 | 1634 |

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT PAPER NUMBER

2815

DATE MAILED: 09/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/305,121

Applicant(s)
Gunapala et al.

Examiner
B. William Baumeister

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2815



— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jun 11, 2002
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 3, 4, 9, 11-16, and 36-39 is/are pending in the application.
- 4a) Of the above, claim(s) 9 and 37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3, 4, 11-16, 36, 38, and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on Mar 5, 2001 is: a) ☐ approved b) ☒ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other:

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DETAILED ACTION

Election/Restriction

1. Applicant's election without traverse of the revised restriction as set forth in Paper No. 20 of Invention IA in Paper No. 21 is acknowledged.

Drawings

2. The corrected or substitute drawings were received on 3/5/2001. These drawings are NOT approved.

- a. Various Figures, apparently including at least FIGs 1, 2, 3A and 3B, should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

- b. Various inconsistencies exist between the reference numerals employed in the specification and in the drawings. For example,

- ✓ i. Reference numeral 120 is used to denote the band-gap of the GaAs well layer (page 4, line 10). Fig 1 includes this label, but also improperly includes the same numeral 120 leading to the conduction band of the barrier region.
 - ✓ ii. Page 4, second full paragraph states that the band gap of the AlGaAs 112 is different from the band gap 120 between the GaAs layers 122. No reference numeral 122 is included in Fig. 1.

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- ✓ iii. Page 5, first full paragraph states that electrons are promoted from one subband 101 to another subband 106. However, FIG 1 does not possess any reference numerals for the conduction subbands, and the valence subbands are labeled 104 and 106 (i.e., subbands for holes, not electrons).
- iv. Page 5, first full paragraph states that promotion is effective at holes 100 in the quantum well (no holes are depicted). Then, in the next paragraph numeral 100 is employed to describe the quantum well, itself--not the holes.
- ✓ v. The specification does not recite reference numeral 102 which is set forth in Fig. 1 leading to the sidewall of the well's conduction band and the bottom of the well's valence band.
- vi. In regard to FIG 2, the specification sets forth numeral "220a" for the ground state (page 5, line 19), while Fig 2 sets forth ground state "220."
- ✓ vii. In FIG. 2, reference numeral 220 is also employed for the rectangle in the continuum.
- ✓ viii. FIG. 2 does not include the reference numeral 228, employed in the specification to describe the thermionic emissions (page 7, line 4).
- ✓ ix. Reference numerals 200, 202, 204 and 206, 212, appearing in FIG 2, are not described in the specification.

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c. The drawings are objected to because FIG 12 labels MWIR QWIP 1200 and LWIR QWIP 1202 as both having barriers composed of $\text{Al}_x\text{Ga}_{1-x}\text{As}$ (i.e., the barriers of both QWIPs are composed of the same compositional ratios), but in contradistinction, FIGURE 12 depicts that the barrier height of the AlGaAs barriers of QWIP 1200 is larger than that of the AlGaAs barriers of QWIP 1202. It is unclear which of the labels and the energy diagram is intended/accurate.

d. Appropriate correction to each and every inconsistency, including those not specifically recited herein, is required.

e. **A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.**

Specification

3. The disclosure is objected to because of the following informalities:

a. The specification sets forth, "the energy level separation and the depth of the quantum well are increased as the thickness of the GaAs layer is decreased." (Page 3, line 21-) It is true that the well thickness will affect the energy level separation, but the well depth is not affected by the well thickness. Rather, the well depth depends upon the height of the adjacent barrier layers.

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b. The statement, "the photoelectrons are bound into the continuum level..." (page 9, lines 3 -) is a non-sequitur.

✓ c. Page 48, lines 14- states: "...a smooth continuum [sic: continuum] transport band..."

4. Appropriate correction to these and any other minor clerical errors is required.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1, 3, 4, 11-13, 15, 16, 36, 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bois et al. '418 in view of Steele, "Importance of the upper state position in the performance of quantum well intersubband infrared detectors," Appl. Phys. Lett. 59 (27), 30 December 1991, pp. 3625-3627.

a. Bois teaches multi-color QWIP arrays composed of plural stacked individual QWIPs (PQ1, PQ2) responsive to different wavelengths, provided on a substrate, separated by a GaAs contact layer and having contacts C1, C2 and C3 attached to the QWIP stack (see e.g., FIG 9b). The wells of one QWIP are composed of GaAs and the wells of the other QWIP may be composed of GaAs/InGaAs/GaAs, while barriers of both QWIPs are composed of AlGaAs (e.g., col. 2, lines 53-; and FIGs 5b, 5c). Hence the conduction band has a smooth energy profile. The wells can also be composed of low-Al-content AlGaAs (col. 3, lines 60-67). Bois does not

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anticipate the claims because it teaches bound-to-bound transitions as opposed to Applicant's claimed bound-to-quasibound transitions.

b. Steele teaches the principles of bound-to-quasibound intersubband transitions. Specifically, it teaches that by properly selecting the well widths and the barrier heights, the upper bound state can be shifted to be resonant with the top of the barrier; and more specifically, that decreasing the well thickness increases energy difference between the subbands and raises the upper subband. Specific examples start with about a 35 meV (or about 12%) difference between the upper bound state and the barrier height energy, the subsequent examples show that the energy difference decreases and the upper energy level moves upwards as the wells are made thinner until the upper energy level is quasi-bound or resonant with the barrier. It further teaches that this resonance improves device responsivity, but that the responsivity drops off sharply once the upper state is pushed into the continuum.

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have designed the barrier and well thicknesses and compositions of Bois so as to produce superlattices having quasi-bound transitions for the purpose of improving the QWIPs' responsivity as taught by Steele.

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bois/Steele as applied to the claims above and further in view Bethea et al. 685 (previously made of record). Regardless of whether either of Bois or Steele further discloses the use of random reflectors,

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Bethea discloses that QWIP detector arrays may further comprise gratings or “diffusely scattering (roughened) surfaces” (or random reflectors) (col. 4, lines 15-21). It would have been obvious to one of ordinary skill in the art at the time of the invention to employ random reflectors in the Bois/Steele QWIP arrays for the purpose of increasing the coupling, as taught by Bethea.

Response to Arguments

8. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

INFORMATION ON HOW TO CONTACT THE USPTO

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at (703) 306-9165. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



B. William Baumeister

Patent Examiner, Art Unit 2815

August 31, 2002